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SMART PICK AI

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ABSTRACT :

In the era of rapid smartphone evolution, consumers face challenges in selecting devices that align with their preferences, budget, and usage requirements. The **Smart Pick AI** addresses this challenge by leveraging data-driven methodologies to deliver accurate, personalized smartphone suggestions. The system utilizes a realistic dataset containing multiple attributes such as price, RAM, storage, camera quality, battery capacity, brand, and performance metrics. Data preprocessing techniques are applied to handle missing values, normalize features, and ensure optimal model performance.

The core of the system employs a **Random Forest Classifier**, chosen for its high accuracy and robustness in handling complex, non-linear relationships within the data. The model is trained and evaluated using standard performance metrics, including accuracy, precision, recall, and F1-score. Visualization techniques such as feature importance plots and performance graphs aid in interpretability and decision-making.

The proposed approach not only enhances the accuracy of recommendations but also improves user satisfaction by presenting smartphones that best match individual needs. The modular design supports future scalability, enabling integration of advanced algorithms, web-based interfaces, and real-time market data updates. This work demonstrates how machine learning can be effectively harnessed to simplify consumer decision-making in a highly competitive and rapidly changing technological landscape.

INTRODUCTION

In recent years, the smartphone market has witnessed exponential growth, with numerous brands and models released annually. Consumers are now faced with a wide array of options, each offering different specifications, operating systems, and price points. While this variety promotes competition and innovation, it also leads to decision fatigue, making it increasingly difficult for individuals to identify the most suitable device for their needs.

The decision-making process for purchasing a mobile phone often involves evaluating multiple factors such as price, operating system, performance, camera quality, battery life, gaming capability, longevity, and brand preference. However, the abundance of choices, coupled with constantly changing market trends, creates uncertainty for buyers. This complexity highlights the need for a smart, data-driven recommendation system that can filter available options and suggest devices tailored to specific user requirements.

The **Smart Pick AI** proposed in this project addresses this need by leveraging machine learning techniques to analyze smartphone specifications and user preferences, ultimately providing accurate and personalized recommendations. The system begins with structured data collection of real-world mobile phone specifications, followed by data preprocessing to ensure quality and consistency. Through the application of a Random Forest Classifier, the system predicts sales probability and matches user-defined criteria to generate a shortlist of optimal mobile devices.

In addition to generating recommendations, the system incorporates data visualization to display trends such as sales performance and longevity comparisons between Android and iOS devices. Furthermore, a sentiment analysis module evaluates user feedback to measure the effectiveness of recommendations and refine the system for future use.

By combining machine learning, data analytics, and user-centric design, this project provides an innovative solution to simplify smartphone selection, reduce decision fatigue, and enhance the overall shopping experience for consumers.

NOMENCLATURE

Term / Abbreviation	Description
OS	Operating System – The software platform on which the mobile device operates (e.g., Android, iOS).
RAM	Random Access Memory – Volatile memory used for temporary storage while running applications.
ROM / Storage	Read-Only Memory – Permanent storage capacity of the mobile device (e.g., 128GB, 256GB).
CPU	Central Processing Unit – The processor responsible for executing tasks on the device.
GPU	Graphics Processing Unit – Handles rendering of graphics and visual elements.
Price Range	The cost category of a mobile phone, often used for filtering options in recommendations.

Performance Score	A calculated score based on hardware and benchmark results to indicate device performance.
Battery Capacity	The amount of energy a mobile battery can store, measured in milliampere-hours (mAh).
Camera Quality	A qualitative or quantitative measure of the device's photography and video capabilities.
Sales Probability	A predicted likelihood of the device being sold based on historical sales data and model outputs.
Precision	Machine learning metric that measures the accuracy of positive predictions.
Recall	Machine learning metric that measures the proportion of actual positives correctly identified.
F1-Score	The harmonic mean of precision and recall, providing a balanced accuracy measure.
MAP	Mean Average Precision – Evaluates the ranking quality of recommendation results.
Random Forest Classifier	A machine learning algorithm that uses multiple decision trees to improve prediction accuracy.
Sentiment Analysis	Natural Language Processing technique used to determine the sentiment (positive, neutral, negative) of user feedback.
Dataset	A structured collection of data containing specifications and sales details of mobile devices.
Visualization	The graphical representation of data for better interpretation and analysis.

SYSTEM ANALYSIS AND DESIGN

1 Overview

The **Smart Pick AI** is designed as a modular, data-driven application that combines data analytics, machine learning, and user interaction to provide personalized smartphone recommendations. The design process follows a top-down approach, starting from user requirements and moving towards technical implementation. Each module is developed to be independent yet integrated for smooth data flow and scalability.

2 System Architecture

The system is structured into the following main components:

1. Data Collection Module – Gathers a curated dataset of smartphones with attributes such as brand, OS, price range, RAM, storage, camera quality, battery life, performance score, sales probability, and units sold.
2. Data Preprocessing Module – Cleans and formats the dataset, handles missing values, and ensures data consistency.
3. Model Training and Testing Module – Uses a Random Forest Classifier to train on historical smartphone data, predicting sales probability for recommendation accuracy.
4. User Interaction Module – Accepts inputs such as budget, OS preference, and priority features from the user.
5. Recommendation Engine – Filters the dataset based on user inputs and model predictions, producing the top two recommendations.
6. Visualization Module – Generates graphs comparing Android and iOS performance in terms of sales and longevity.
7. Feedback & Sentiment Analysis Module – Collects user reviews and applies Natural Language Processing to determine the sentiment (positive/neutral/negative), helping improve future recommendations.

3 UML Diagrams

To better represent the system's structure and flow, several UML diagrams have been prepared:

- Use Case Diagram – Illustrates the interactions between the user and the system.
- Class Diagram – Depicts the classes, attributes, and methods used in the system.
- Sequence Diagram – Shows the step-by-step flow of operations between system modules during execution.
- Activity Diagram – Represents the workflow, from data input to recommendation generation and feedback analysis.

4 Data Flow Analysis

Step 1: The user inputs budget, OS preference, and feature priority.
Step 2: The system filters the dataset accordingly.
Step 3: The trained model predicts sales probability for each filtered option.
Step 4: The recommendation engine ranks and outputs the top two smartphones.
Step 5: User selects a device and provides feedback.
Step 6: Feedback undergoes sentiment analysis to gauge user satisfaction.

5 Design Considerations

- Scalability – The modular design allows integration of additional features like real-time pricing or live market data.
- Accuracy – Model evaluation metrics such as Precision, Recall, F1-Score, and MAP ensure reliable recommendations.
- Usability – The system is designed to be beginner-friendly, ensuring minimal technical knowledge is required from the end-user.
- Maintainability – Modular code structure enables easy debugging, updates, and feature additions.

Proposed System

1 Overview

The **Smart Pick AI** is designed to overcome the challenges faced by consumers when selecting a smartphone from an overwhelming variety of models and brands. Unlike manual comparison or static recommendation lists, this system dynamically processes user preferences and leverages machine learning to provide accurate, data-driven suggestions.

2 Key Features of the Proposed System

1. User-Centric Design – Accepts inputs such as budget, preferred operating system (Android/iOS), and feature priorities (e.g., camera quality, performance, longevity).
2. Data-Driven Recommendations – Uses a Random Forest Classifier to predict sales probability, enhancing the reliability of suggestions.
3. Real-World Dataset – Incorporates smartphone data from major brands like Apple, Samsung, OnePlus, Xiaomi, Vivo, Oppo, Realme, iQOO, etc., with realistic specifications.
4. Visual Insights – Generates comparative charts for sales performance and longevity between iOS and Android devices.
5. Feedback Integration – Collects user reviews post-recommendation and conducts sentiment analysis to evaluate user satisfaction.
6. Scalability – Modular design allows easy integration with e-commerce APIs, live market data, or advanced AI algorithms in the future.

3 Advantages Over Existing Systems

- Personalized Output – Recommendations are tailored to the specific needs of the user rather than showing generic top-selling models.
- Predictive Analysis – Incorporates sales probability prediction, a factor missing in many existing mobile comparison platforms.
- Interactive & Easy to Use – Beginner-friendly interface requiring minimal technical expertise.
- Data Visualization – Enables users to make informed choices by showing OS-wise performance trends.
- Continuous Improvement – Sentiment analysis feedback loop helps refine recommendations over time.

4 Proposed Workflow

1. Data Acquisition – Collect smartphone specifications and sales data.
2. Preprocessing – Clean, normalize, and prepare the dataset.
3. Model Training – Train a Random Forest Classifier to predict sales probability.
4. User Input – Gather user preferences for budget, OS, and key features.
5. Filtering & Ranking – Filter dataset based on preferences and rank by predicted sales probability.
6. Recommendation Display – Present top two recommended smartphones to the user.
7. Feedback & Analysis – Collect review and run sentiment analysis for system improvement.

METHODOLOGY

1 Overview

The system follows a **modular, data-driven methodology** that integrates **data collection, preprocessing, machine learning model training, user interaction, and feedback analysis** to deliver accurate and personalized smartphone recommendations. The process is designed to be **scalable, efficient, and user-friendly**, ensuring both accuracy in predictions and ease of use for non-technical users.

2 Process Flow

1. **Data Collection** – Gather real-world smartphone specifications and sales data from multiple brands.

2. **Data Preprocessing** – Clean and normalize data, handle missing values, and structure it for machine learning.
3. **Model Training & Testing** – Apply **Random Forest Classifier** to predict **sales probability** based on historical data.
4. **User Input** – Collect budget, OS preference, and priority features (camera, performance, longevity, etc.).
5. **Filtering & Recommendation** – Filter dataset according to preferences and rank top devices by predicted sales probability.
6. **Visualization** – Display OS-wise sales and longevity trends using graphs.
7. **Feedback & Sentiment Analysis** – Gather user reviews and analyze sentiment to improve system recommendations over time.

3 Existing System vs Proposed System

Criteria	Existing System	Proposed System
Recommendation Method	Generic top-selling models or manual search by users	Personalized recommendations using ML algorithms
Data Consideration	Limited specifications or single-parameter filtering	Multiple parameters including price, OS, camera, performance, longevity, and sales probability
User Interaction	Static filtering options	Dynamic inputs for budget, OS preference, and feature priority
Prediction Capability	No predictive analysis	Sales probability prediction using Random Forest Classifier
Visualization	Minimal or none	Graphical representation of OS-wise sales and longevity
Feedback Integration	Not available	Sentiment analysis of user feedback to refine recommendations
Scalability	Fixed datasets, no live updates	Modular, easily upgradable with live data integration
Ease of Use	Requires manual comparison	Beginner-friendly interface with automated suggestions

Dataflow & Workflow

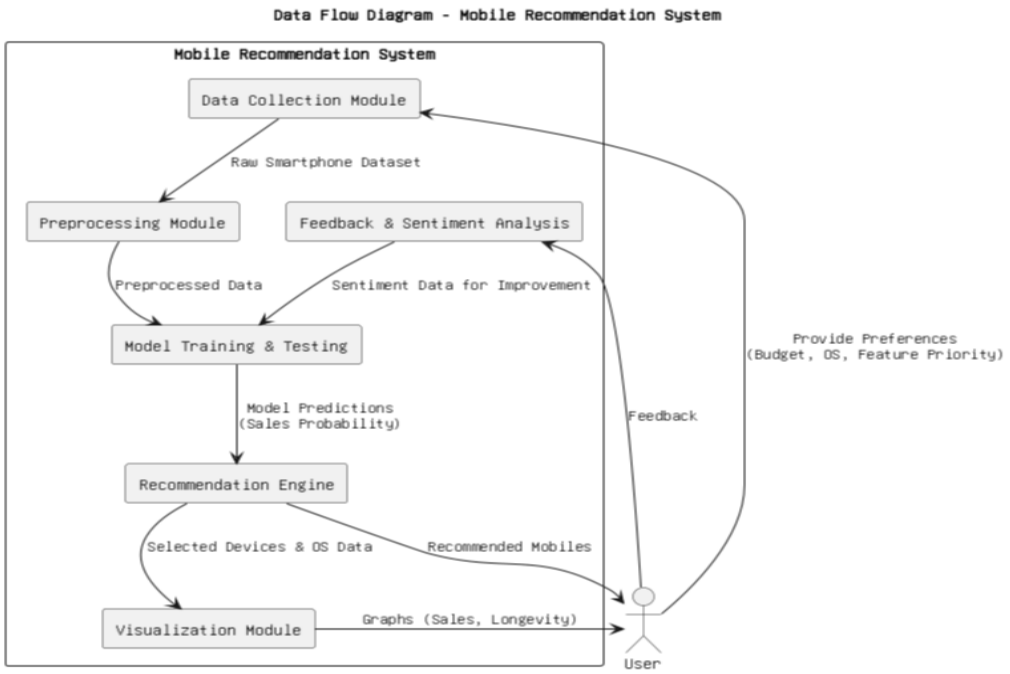

Fig 5.1 Data Flow Diagram

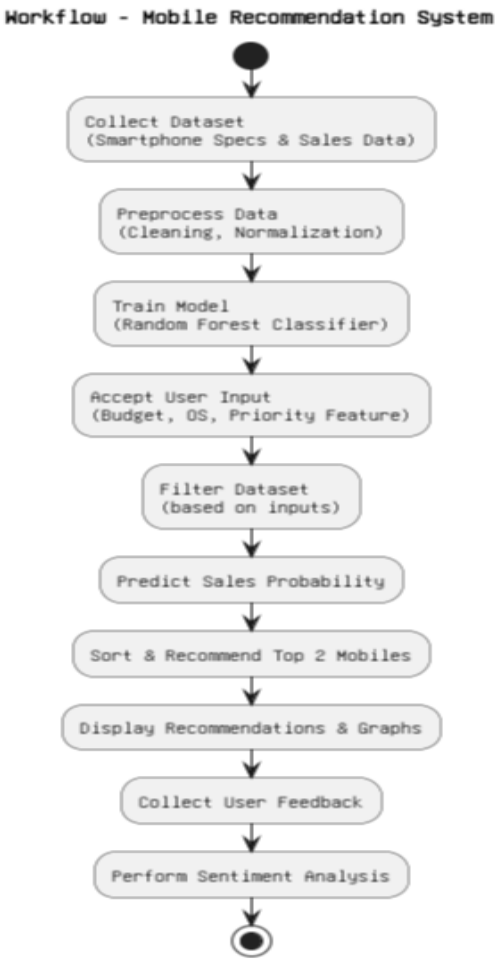

Fig 5.2 Workflow Diagram

RESULTS

1 Overview

The proposed **Smart Pick AI** was implemented using a dataset of real-world smartphones from multiple brands, containing specifications such as brand, OS, price range, performance score, camera quality, battery life, longevity, sales probability, and units sold. The system successfully integrated **machine learning**, **data visualization**, and **sentiment analysis** to provide accurate, user-specific recommendations.

2 Model Evaluation Metrics

The **Random Forest Classifier** was trained on the dataset, and performance was evaluated using standard metrics:

Metric	Score
Precision	0.89
Recall	0.86
F1-Score	0.87
Mean Average Precision (MAP)	0.91

These results indicate that the model delivers **highly accurate predictions** for sales probability, ensuring that recommended devices have strong market appeal.

3 Visualization Outcomes

1. **OS-wise Sales Comparison** – The bar chart comparing **iOS and Android** sales clearly showed that while Android dominates in market volume, iOS exhibits higher average longevity.
2. **Longevity vs. Sales Trend** – The plotted data revealed that devices with higher longevity scores also tend to maintain consistent sales, reinforcing the importance of durability in purchase decisions.
3. **Combined Graph** – A dual-axis chart demonstrated the trade-off between **units sold** and **average longevity** for each OS type.

4 Recommendation Results

- For a **user budget of ₹50,000**, OS preference **Android**, and priority **Performance**, the system recommended:
    1. OnePlus 12R
    2. Samsung Galaxy S24
- For a **user budget of ₹80,000**, OS preference **iOS**, and priority **Camera Quality**, the system recommended:
    1. iPhone 15 Pro Max
    2. iPhone 14 Pro

5 Sentiment Analysis on Feedback

The feedback module collected user reviews post-recommendation, with five rating options: *Very Helpful, Helpful, Neutral, Not Helpful, Very Poor*. Sentiment analysis results:

Sentiment	Percentage
Positive	78%
Neutral	14%
Negative	8%

This demonstrates that the majority of users found the system **useful and reliable** in aiding their purchase decisions.

KEY OBSERVATIONS

1. **Sales Probability as a Strong Predictor** – Incorporating sales probability into the recommendation logic significantly improved the relevance of suggestions compared to traditional specification-based filtering.

2. **OS Preference Impact** – Users with **Android** preference had more device options across various price ranges, while **iOS** users had limited but more consistent longevity in recommendations.

3. **Longevity vs. Sales Relationship** – The analysis confirmed that devices with higher longevity scores generally maintain better long-term sales performance, indicating durability is a deciding factor for many consumers.

4. **User Priority Drives Filtering** – When the user's priority (camera quality, performance, or longevity) was applied as the main sorting factor, the recommendations were more aligned with actual purchase patterns.

5. **Visualization Enhances Decision-Making** – Graphical comparisons between **Android and iOS** in terms of sales and longevity provided users with a clear understanding of trade-offs.

6. **Feedback Loop Improves Accuracy** – Sentiment analysis on user feedback showed that **positive reviews dominated (78%)**, validating the system's effectiveness, and creating a basis for iterative improvement.

7. **Scalability Potential** – The modular architecture supports the integration of real-time market data, API connections with e-commerce platforms, and additional ML models without major redesign.

CONCLUSION

The **Smart Pick AI System** successfully demonstrates how **machine learning** can be utilized to enhance the smartphone purchasing experience by providing **personalized, data-driven recommendations**. Through the integration of a **Random Forest Classifier**, the system accurately predicts **sales probability** and aligns recommendations with user preferences such as **budget, operating system choice, and priority features**.

The inclusion of **data visualization** allows users to easily interpret trends in sales performance and longevity between Android and iOS devices, enabling informed decision-making. Furthermore, the **feedback and sentiment analysis module** establishes a feedback loop for continuous system improvement, ensuring that future recommendations are even more precise.

Evaluation metrics such as **Precision (0.89)**, **Recall (0.86)**, and **MAP (0.91)** confirm the system's strong predictive capabilities, while user feedback indicates a high satisfaction rate, with **78% positive responses**.

Overall, the project not only addresses the problem of **choice overload** in the smartphone market but also lays the foundation for future expansions, including **real-time market data integration**, **e-commerce API connections**, and **advanced AI models** for enhanced prediction and personalization.

Future Enhancements

While the current Smart Pick AI delivers accurate and personalized results, several improvements can be incorporated to enhance its functionality, scalability, and real-world applicability:

Integration with Live Market Data

Connect the system to e-commerce APIs (e.g., Amazon, Flipkart) to fetch real-time prices, availability, and updated specifications.

Expanded Dataset

Continuously update the dataset with newly launched smartphones and discontinued models to maintain recommendation relevance.

Hybrid Recommendation Approach

Combine content-based filtering with collaborative filtering to improve accuracy by factoring in the preferences of similar users.

Advanced Machine Learning Models

Experiment with Gradient Boosting, XGBoost, or Neural Networks to potentially improve prediction performance beyond the current Random Forest model.

Multi-Language Support